

What is claimed:

1. A process for preparing a hydrocyanation catalyst comprising contacting at least one bidentate phosphorus-containing ligand selected from the group consisting of bidentate phosphites, bidentate phoshinites, and bidentate phosphines with nickel chloride in the presence of a nitrile solvent and a reducing metal which is more electropositive than nickel, the nickel chloride being in molar excess with respect to the reducing metal.

2. The process of claim 1 wherein the reducing metal is selected from the group consisting of Na, Li, K, Mg, Ca, Ba, Sr, Ti, V, Fe, Co, Cu, Zn, Cd, Al, Ga, In, and Sn.

3. The process of claim 2 further comprising separating unreacted nickel chloride from the hydrocyanation catalyst.

4. The process of claim 2 where the reducing metal is Zn or Fe.

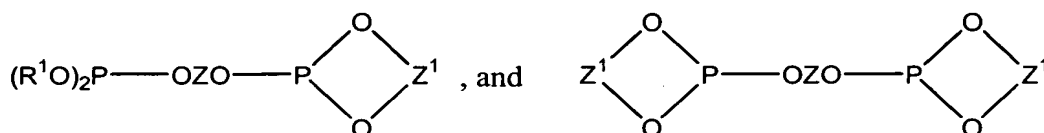
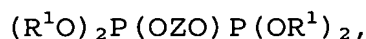
5. The process of claim 4 wherein the catalyst preparation is conducted at a temperature of 30 to 100 °C and at a pressure of 5 to 50 psia (34 to 340 kPa).

6. The process of claim 5 wherein the catalyst preparation is conducted at a temperature of 50 to 90 °C.

7. The process of claim 6 wherein the molar ratio of nickel chloride to reducing metal is 1.1:1 to 50:1.

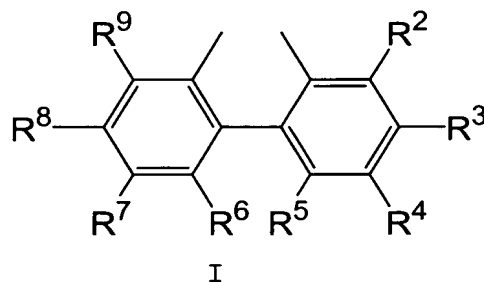
8. The process of claim 7 wherein the molar ratio of nickel chloride to reducing metal is 2:1 to 25:1.

5 9. The process of claim 8 wherein the bidentate phosphorous-containing ligand is a compound of the formula



wherein:

R^1 is phenyl, unsubstituted or substituted with one or more C_1 to C_{12} alkyl or C_1 to C_{12} alkoxy groups; naphthyl, unsubstituted or substituted with one or more C_1 to C_{12} alkyl or C_1 to C_{12} alkoxy groups; Z and Z^1 are independently selected from the group consisting of radicals having the formulae I, II, III and IV:



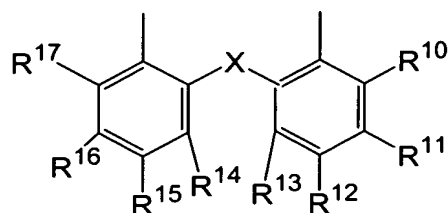
wherein:

R^2 and R^9 are the same and are selected from H, C_1 to C_{12} alkyl, and C_1 to C_{12} alkoxy; R^3 and R^8 are the same and are selected from H, C_1 to C_{12} alkyl, and C_1 to C_{12} alkoxy;

R^4 and R^7 are the same and are selected from H, C_1 to C_{12} alkyl, and C_1 to C_{12} alkoxy;

R^5 and R^6 are the same and are selected from H, C_1 to C_{12} alkyl, and C_1 to C_{12} alkoxy;

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II

10 wherein:

X is O, S, or $CH(R^{18})$;

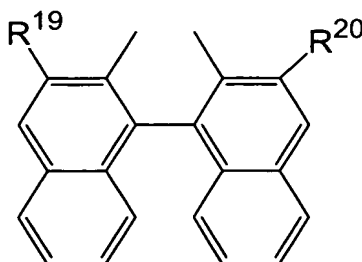
R^{10} and R^{17} are the same and are selected from H, C_1 to C_{12} alkyl, and C_1 to C_{12} alkoxy;

R^{11} and R^{16} are the same and are selected from H, C_1 to C_{12} alkyl, and C_1 to C_{12} alkoxy;

R^{12} and R^{15} are the same and are selected from H, C_1 to C_{12} alkyl, and C_1 to C_{12} alkoxy;

R^{13} and R^{14} are the same and are selected from H, C_1 to C_{12} alkyl, and C_1 to C_{12} alkoxy; and

R^{18} is H or C_1 to C_{12} alkyl;



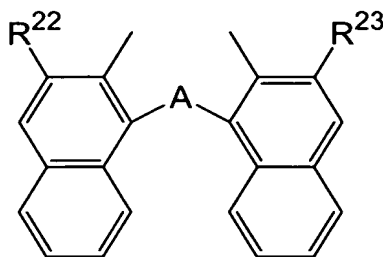
III

25 wherein:

R^{19} and R^{20} are the same and are selected from H and CO_2R^{21} ;

R^{21} is C_1 to C_{12} alkyl or C_6 to C_{10} aryl, unsubstituted or substituted with C_1 to C_4 alkyl groups;

5



IV

wherein:

A is O, S, $CH(R^{24})$;

R^{22} and R^{23} are the same and are selected from H and CO_2R^{25} ;

R^{24} is H or C_1 to C_{12} alkyl;

R^{25} is C_1 to C_{12} alkyl; or

10. The process of claim 9 wherein the nickel chloride is unreacted nickel chloride which has been separated from hydrocyanation catalyst prepared according to claim 3.

11. The process of claim 9 wherein the nickel chloride is anhydrous.

12. The process of claim 11 wherein the anhydrous nickel chloride is produced by a process comprising treating hydrated nickel chloride at a temperature of about 200 to about 240°C for a time less than 12 hours.

13 The process of claim 12 wherein the hydrated nickel chloride is $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$ or $\text{NiCl}_2 \cdot 2\text{H}_2\text{O}$.

14 The process of claim 11 wherein the anhydrous nickel chloride is produced by a process comprising:
 5 (a) spray drying an aqueous solution of nickel chloride at an exit temperature of about 120 to about 150°C; and
 (b) thermally drying the product of step (a) at a temperature between about 200 to about 240°C for a time of
 10 less than 12 hours.

15 15. The process of claim 14 wherein the spray drying exit temperature is about 130 to about 135°C with a mean residual time of heat exposure between 1 and 45 seconds.

16. The process of claim 15 wherein the reducing metal has a particle size of 20 mesh or less.

17. A process for producing anhydrous nickel chloride comprising treating hydrated nickel chloride at a temperature of about 200 to about 240°C for a time less than 12 hours.

18. The process of claim 17 wherein the hydrated nickel chloride is $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$ or $\text{NiCl}_2 \cdot 2\text{H}_2\text{O}$.

19. The process of claim 17 comprising:
 (a) spray drying an aqueous solution of nickel chloride
 30 at an exit temperature of about 120 to about 150°C; and
 (b) thermally drying the product of step (a) at a temperature between about 200 to about 240°C for a time of less than 12 hours.

20. The process of claim 19 wherein the spray drying exit temperature is about 130 to about 135°C, with a total exposure time between 1 and 45 seconds.

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